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THE CARDIAC PHASE OF THE WAR NEUROSES.*

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IN an inquiry into the state of our own knowledge, it is useful to institute a comparison of our thoughts with those held at a former stage of development of the same subject. It is especially gratifying to be called upon to do this in the present instance, because the first serious attention was given to this matter by Da Costa, an American, and the study was of so excellent a nature as to leave no doubt that a recognizable malady had been described.

In 1871, Da Costa¹ published the account of an affection called by him "The Irritable Heart of Soldiers," in which palpitation of the heart, cardiac pain, rapidity of the heart-rate, shortness of breath and nervous disorders, such as headache, giddiness and disturbed sleep, were the dominant complaints. Associated with these, he mentioned hyperesthesia of the skin, blueness of the lips and hands and a mottled condition of other portions of the skin. Indigestion, abdominal distention and diarrhea, itching and sweating were also noticed. In certain cases, Da Costa found that the heart was normal in size, and in them it was his opinion that the affection was functional. In others he found the organ hypertrophied. In neither group was a cardiac murmur an important

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¹ On Irritable Heart: A Clinical Study of a Form of Functional Cardiac Disorder and its Consequences, *AM. JOUR. MED. SC.*, 1871, i, 52.

finding. He believed that the functional and organic affections, "apparently dissimilar states, were in reality one, or rather that one grew out of the other," and, further, that he could "demonstrate . . . the links connecting the disorders." The disorder, he thought, "either gradually subsides or it passes by degrees into cardiac enlargement." He founded the treatment on rest, and aided it by giving digitalis, atropin and aconite to relieve one or other of the symptoms, for which each remedy appeared to be especially serviceable. The soldiers, "before being sent back to their regiments, were tested by running and other exercises, with a view to seeing how the action of the heart was affected." Some he "had the opportunity of examining after they had rejoined their regiments," and of others he heard that "they were fully able to fulfil all required of them." Of especial interest is Da Costa's conception of the cause of the malady. He did not believe that he had come upon a new affection. He thought that similar complaints must have existed, and he studied, accordingly, the medical military history of other armies. He found, for instance, that "palpitation" was a cause for invaliding home to England from hospitals of the Army of the East in the Crimean War. He found mention of it also in Sir Henry Havelock's army in India. But he failed to find it mentioned in Sir John Moore's retreat, in Lord Clive's campaign in India, in Napoleon's campaign culminating in the surrender at Ulm and in his retreat from Russia. He looked for mention of it especially in these campaigns because he expected to find it in troops that had been exposed to enormous exertion, such as had been the case in these. And he was impressed with its frequency in the Northern Army in the Civil War. "Whether among the Southern Armies the same affection was common I am unable to say, though from some facts that have been mentioned to me I think it was. And it would be strange, indeed, if men of the same race, transformed into soldiers under much the same circumstances, and though operating oftener on interior lines, enduring, on the other hand, generally more privations, should have escaped. "We find," he says, "quick and long marches, heavy work, producing the affection, or even slight exertion in those whose constitution has been impaired by insufficient or indigestible food, or whose strength has suffered, or condition of the heart been disturbed by diarrhea or fever. We find it most readily developed in those previously weak and unaccustomed to fatigue or subject to rapidly quickened circulation. We find it kept up by irksome equipment and other causes, but not generated by them."

That the affection was not distinctly recognized and described earlier does not surprise Da Costa. To those who have followed the rapid additions to knowledge in the study of the behavior of the heart in the last fifteen years the observation which follows has special interest. To have recognized the affection would have been

surprising, "when," as he says, "we reflect how almost entirely the accurate knowledge of diseases of the heart is the knowledge of our time."

From Da Costa, then, we have the description of an affection so clear that there was no difficulty in identifying the cases when they appeared in the armies during this war. To his conception of the disorder, as depending upon infection and exertion and of his system of therapy, there will be occasion to return in the discussion.

Since then the affection was seen and described in India by MacLeod,² and by him was attributed to campaigning in the tropics, and was, in consequence, called the "Tropical Heart." Disability from unexplained cardiac causes had been so great that the British War Office at one time accepted the suggestion that the form of accoutrements might be responsible for the difficulty, and, therefore, altered the crossed straps for support of the soldier's pack.³ A similar thought had come also to Da Costa.

Between the Civil War and the war just finishing there has been mention a number of times of similar affections. It is, I believe, correct to say, however, that it was Da Costa's opinion which exerted the greatest influence in this field.

During the present war, cases appeared in such numbers as to direct attention to them in the Allied Armies and in those of the Central Powers. Many studies have been made in Germany and Austria, in Italy, France and England, and, more recently, in our own country. I believe the number of papers so far published exceeds 250.

In England the need for directing opinion was soon felt. The Medical Research Committee, organized under the National Health Insurance, made a first report in 1915-1916 of the investigations of cardiac disorders of military importance. In England, early in 1916, the Director-General of the Army Medical Service set aside the Hampstead Military Hospital, where these so-called cases of "Irritable Heart of Soldiers" were received for study and treatment. An advisory committee, consisting of Sir Clifford Allbutt, Sir James Mackenzie and Sir William Osler, was appointed. Dr. Thomas Lewis was called to take active charge of the work. The forethought of the British authorities in providing for the study of this important affection had important results. The usefulness of their "Report upon Soldiers Returned as Cases of 'Disordered Action of the Heart' (D. A. H.) or 'Valvular Diseases of the Heart' (V. D. H.)," written by Dr. Thomas Lewis and his collaborators,⁴ deserves special notice. To the same authorities

² Tropical Heart, *Jour. Trop. Med.*, 1898, i, 3-4.

³ Wilson, R. McN.: The Irritable Heart of Soldiers, *British Med. Jour.*, 1916, i, 119-120.

⁴ Disordered Action of the Heart (D. A. H.) or Valvular Diseases of the Heart (V. D. H.). Special Report Series No. 8, Medical Research Committee, National Health Insurance.

and to Dr. Lewis the U. S. Army is in debt for their interest in the training and instruction of the medical officers selected by the Surgeon-General's office for subsequent duty in the American Expeditionary Forces. Following the example set by the British, Major Janeway first and Colonel Longcope later made plans for the further pursuit of these studies in the United States. The Surgeon-General, accordingly, set aside 200 beds at U. S. General Hospital No. 9 at Lakewood, where a service was organized and work was carried on under the direction of Major Francis W. Peabody.

A catalogue of the symptoms of the disorder contained in the British and in other reports is not essentially different from that given by Da Costa.

I give now the description of a severe case—a not uncommon picture:

The patient is obviously distressed. His face bears the marks of anxiety; he is likely to be thin; his eyes are troubled; there are vertical furrows in his brow, the lines about his nose and mouth are drawn. His lips are bluish; his skin mottled; his hands often purple. He trembles and his trembling is a coarse shake. The shake involves his extremities, often only his hands, but I have seen men shake, arms and legs, and sometimes their bodies and heads as well. He presents a memorable picture.

He has reported sick for one of several reasons: because of breathlessness, on account of which he has been forced to fall out on hikes; because of pain in the chest, or sense of fatigue or of dizziness, or because of palpitation in his chest.

On examination the motions of the extremities are coarse and their extent is likely to increase when attention is directed to them. The skin is cold, the palms wet and clammy; profuse sweat pours from the axillæ, though the room is cool; there are areas of hyperesthesia of the skin, especially over the precordium, or, as Robey and Boas⁵ have shown, areas of hypesthesia; the tendon reflexes are exaggerated; the mucous membrane reflexes are gone. The examination of the separate organs shows no striking abnormality. The size of the heart, as Meakins and Gunson⁶ have shown, is no larger than that of normal persons, when attention is paid to body weight. There is reason to think that this need not always be true, for soldiers after campaigning may have larger hearts than persons not subject to this exertion. Karsner⁷ has called attention to this fact in a study of the weight of the heart in soldiers who were in the war more than twenty-two months and who were more than twenty-seven years old. In the measurements which I made

⁵ Neurocirculatory Asthenia, *Jour. Am. Med. Assn.*, 1918, lxxi, 525-529.

⁶ Orthodiagraphic Observations on the Size of the Heart in Cases of So-called "Irritable Heart," *Heart*, 1918, vii, 1-16.

⁷ Acute Endocarditis Following War Wounds, Including Notes of Heart Weight and Arteriosclerosis in Soldiers, *Arch. Int. Med.*, 1918, xxii, 296-311.

on 211 soldiers returned from hard service with the American Expeditionary Forces there was, however, no difference between the size of their hearts and the figures published by Dietlen.⁸ There need be no murmur. But when one considers how frequently systolic murmurs have been found during the draft examinations, one expects that unimportant murmurs will be found in a number of cases. The heart-rate is elevated and lies between 90 and 130—in 75 per cent. of the cases, according to Hume;⁹ the rate may reach over 150; but in about 10 per cent. the rate may be below 80. The blood-pressure as observed by Lewis, Cotton and Rapport¹⁰ and by Sturgis¹¹ is usually normal. Sturgis made a careful study of this point at U. S. General Hospital No. 9 and found that with proper attention to technic the systolic and diastolic pressures were quite normal, the systolic pressure being 117 mm. and the diastolic 75 mm. No doubt if pressures are read just after men have reported for examination the pressures may be high, sometimes 140 mm. or more. The high level then probably results from the elevation of rate, due no doubt, to excitement, though in examining recruits it was noticed that equally high pressures exist without elevation in rate. I do not discuss the mechanism of this phenomenon.

The breathing is rapid and shallow. The rate usually is 40, but rates of 80 have been described, and on rare occasions a constant rate as high as 200 has been seen.

This, then, may serve as a general description of the symptoms and signs. I have chosen to describe a severe case. After the experience at Colchester, where cases were severe rather than mild, one was not at first prepared for the mild cases which appeared in the hospitals of the American Expeditionary Forces in the spring and early summer of 1918. A single complaint of a mild order was rather the rule. Late in the summer and in the autumn the severe grades were common.

There will be no serious difference of opinion among medical officers that there are large numbers of cases of this sort. In the British Army, 421,877 men were discharged as unfit to August 31, 1918. Of these, 41,699, or about 10 per cent., were discharged on account of heart disease; most of them probably of the type called "Disordered Action of the Heart" (D. A. H.). In the United States Army there were rejected from February 18 to October 15, 1918, 467,694 men, of whom 61,142, or 13.07 per cent., were rejected for heart or bloodvessel defects. These figures probably include rejections at the draft and discharge from service for unfitness.

⁸ *Deutsch. Arch. f. klin. Med.*, 1907, lxxxviii, 55.

⁹ Study of the Cardiac Disabilities of Soldiers in France, *Lancet*, 1918, i, 529-534.

¹⁰ After-effect of Exercise on Pulse-rate and Systolic Blood-pressure in Cases of "Irritable Heart," *Heart*, 1915-17, vi, 269-298.

¹¹ Personal Communication. Observations to be published.

But when the nature of the symptoms is considered, together with the physical signs, all pointing clearly to derangement of the organs of circulation, opportunity is provided for divergence of interpretation of the significance of the symptoms.

I have already indicated Da Costa's belief. Sir Clifford Allhutt¹² appears to think that the researches of Lewis and Barcroft's "seem to discover a new disease, or, rather to discriminate more exactly the features and nature of a disease less clearly apprehended already by Da Costa and others as 'soldier's heart,' or by those of us who have written upon 'neurasthenia' as 'cardiac neurasthenia.'" And Sir James Mackenzie¹³ comes to this opinion: "Taking into consideration all the facts, it will be found that the condition from which certain of these soldiers suffer, who are usually understood to have acquired a heart affection, is not, properly speaking, cardiac in origin, but is the outcome of an injury to other systems as well as the heart, such as the central nervous system." In describing the treatment he says: "They often feel miserable, so that there is a mental side to the case which is aggravated by the supposition that there is something amiss with the heart." His view is that the main trouble is one of exhaustion, the phenomena of exhaustion being more evident in one organ in one case and in other organs in other cases. Mackenzie considers the relation of cases of this type to infection and intoxication, but is inclined to separate them both in etiology and in treatment.

Lewis¹⁴ has given a detailed description of his conception of the "effort syndrome." "When a healthy man takes exercise, and this exercise is sufficiently stressful or prolonged, he becomes aware at the time of the effort, or after it has ceased, of certain symptoms, and he presents certain physical signs." Lewis describes the signs and symptoms in detail and then continues as follows: "To these physiological symptoms and signs briefly described as a group. I apply the term 'physiological syndrome of effort.' The term is used as a convenient description of the chief changes, subjective and objective, which are manifested by the human body in its relation to exercises. When I use the term 'effort syndrome' I have in mind the symptoms and signs which follow exercise in health, but I believe I recognize the same or a very similar group of symptoms and signs in a large class of patients in ill health. In patients of this class if no signs of disease are anywhere discovered I say that they suffer from the 'effort syndrome.'" In discussing the relation of the "effort syndrome" to the nervous system he has this to say: "In describing these nervous manifestations I do not wish to be

¹²The Investigation of the Significance of Disorders and Diseases of the Heart in Soldiers, *British Med. Jour.*, August, 1917, ii, 139-141.

¹³The Soldier's Heart, *British Med. Jour.*, 1918, i, 117-119.

¹⁴The Soldier's Heart and the Effort Syndrome, London and New York, 1918, pp. 3 ff. and p. 49.

misread. These symptoms do not stand by themselves in our patients. I regard them as additions. Few of them are, I think, essential parts of the 'effort syndrome.' Nevertheless in many of our patients the condition of the nervous system, whether it be hereditary or acquired, is such as to exaggerate those complaints which belong properly to the 'effort syndrome.' "

The symptoms which have been described may clearly be referred to the heart and circulation. But they do not correspond specifically to any given lesion of this system. They have, in consequence, by different observers, been associated with a variety of diseases, and that one or other of these associations exists has been maintained with some heat. Obviously, such symptoms occur: (1) In chronic diseases of the heart, both of the endocardium and myocardium. (2) There can be no doubt also that they occur in relation to acute infectious diseases, in which connection they are familiar. (3) They are seen in the state of hyperthyroidism. (4) They are included in the symptoms of the neuroses in peace as well as in war.

It is necessary to discuss the arguments advanced in favor of each of these views:

1. I take those views relating the symptoms to an affection of the heart. Few physicians now believe that a valvular disease exists whenever a murmur is heard. There was always general appreciation of the fact that many individuals presented murmurs that were of no prognostic importance. But it is, no doubt, safe to say that the frequency of these in the recruits that were examined during the past two years was unexpected. In 214 soldiers who had seen hard service overseas, that I examined with care, I found murmurs in 109 instances, or 50 per cent. In 68 the murmur was heard in the recumbent posture only; in 13 in the erect posture only; in 28 it was heard in both positions. One examines the relation of the murmurs to phases of respiration more carefully than formerly and attends more than formerly to the influence of posture. Without doubt the presence of insignificant murmurs has occasioned the rejection of many men for service in the army. These murmurs are usually *smooth* and accompany or follow the first sound. But *rough* murmurs immediately preceding or forming part of the first sound have also occasioned difficulty. One is familiar with this type of roughening of the first sound when the rate is rapid, and especially when there is exaggeration of the heart's action. It is possible that this roughening has been taken as a sign of mitral stenosis, the more in that the second sound is accentuated. These signs have, I am afraid, been given too great importance, the more because their occurrence exceeded in number the incidence of mitral stenosis at autopsy, 196 in 4791, or 4 per cent. at Guy's Hospital, according to the statistics of Samways, quoted by Osler.

The size of the heart has been another misleading sign in the distinction of these cases from chronic heart disease. Wenckebach,¹⁵ Karsner¹⁶ and others have indicated that the hearts of soldiers are greater than those of controls. Although without systematic roentgenological confirmation, many physicians in the Expeditionary Forces formed the same opinion, but measurements which I have recently made give a different result. Since their return to America, through the courtesy of General Shanks at the port of Hoboken, I have been able to examine 211 soldiers. The average size in these corresponds closely to the figures given by Dietlen. Given, then, possibly the enlarged heart of soldiers, the insignificant murmurs and the complaints of the men which seem to point to malfunction of the heart, it would be remarkable if the suspicion had not arisen that chronic heart disease is present. It has been shown, on the other hand, by Meakins and Gunson¹⁷ that in most of their cases of Irritable Heart the heart was actually smaller than the controls. To differentiate, involves, on occasion, making a nice distinction. But when all the factors concerned, the personal history, the circumstances of the war and an appraisal of the physical signs are taken into account there are a large number of cases in which one is satisfied that organic heart disease does not exist.

2. The relations of the symptoms of the Irritable Heart to convalescence from acute infectious disease is important, for it has been held by competent physicians that the cause of the Irritable Heart depends on this. Da Costa, for instance, believed that fevers, especially diarrheal fevers, were likely to be followed by cardiac symptoms. The experience is, I believe, general that after acute infectious diseases it is not uncommon to find that the rate of the heart remains elevated; it is frequent in acute rheumatic fever; it is true sometimes in lobar pneumonia, in tuberculosis and in typhoid fever. It is said to have been not uncommon after trench fever, and, according to Bridgman, in influenza. Tachycardia in the convalescence from these diseases is on occasion associated with pain and shortness of breath; it is almost a rule that patients are for some time after recovery from the infection unable to work as well as before. If the attempt to work is made the sense of fatigue or more uncomfortable sensations still soon terminate the effort. When the cardiac symptoms are accompanied by nervous phenomena the nervous symptoms may be regarded as being super-added to the cardiac ones and the two together taken to represent an occurrence apart from convalescence. It is doubtful whether nervous symptoms such as are seen in the Effort Syndrome, the name used to designate the Irritable Heart in the Expeditionary

¹⁵ Ueber Herzerkrankungen bei Kriegsteilnehmern, Verhandl. d. a. Tagung. d. I. Kong. f. inn. Med. in Warschau, 1916, pp. 50-67.

¹⁶ Loc. cit.

¹⁷ Loc. cit.

Forces, are common under these circumstances. There should be no difficulty in recognizing this condition. It runs a more or less definite course and ends in recovery.

Convalescence from an acute infectious disease assuredly cannot be urged as the cause of irritable heart, when, as happened in so many cases, there had been no infectious disease. Nor even if there has been an infectious disease like trench fever can this be said to be the cause of the Irritable Heart when a similar convalescent state is found following other infections. The heart in convalescence after acute infectious diseases and the Irritable Heart are probably not the same thing.

3. To distinguish the Irritable Heart of soldiers from the hyperthyroid heart presents genuine difficulties, for there are similarities between the two conditions. In both the rate is rapid, the size of the heart often greater than normal, abnormal sounds dependent on the rapid rate and on overaction are likely to be present and a shake or tremor of the extremities is common. There may be diarrhea; there is exophthalmos or the semblance of it. The similarities between the two conditions must be admitted, but there are grounds for disbelieving that patients suffering from the Irritable Heart are cases of hyperthyroidism. In the first place there is no genuine exophthalmos, but the look of anxiety which often gives the appearance of prominence to the eyes. Then in many soldiers who live near the Great Lakes or in the northern tier of States a thyroid tumor has been found. It has indeed been shown by McNee and Dunn in the British Army that the thyroid gland was heavier than normal in 65 healthy men killed in action. The weight given by them is 26.7 gm. Weighing the gland, they contend, shows the presence of enlargements not indicated by physical examination. These tumors are, however, as often present, as Addis and Kerr¹⁸ have shown, in men who have not the Irritable Heart. The tremor of Graves's disease is not found, but instead there is a coarse shake, the excursion of which increases while attention is given to it. The rate of the heart is not continuously high but falls during rest and sleep. If in Graves's disease the heart and the breathing attained rates as high as in the Irritable Heart, it is almost certain that during rest and sleep the high rates would be maintained and the breathing would be carried on with difficulty. In point of fact the situation is different in the Irritable Heart. During rest and sleep the rates of breathing and of heart-beat fall to normal. Peabody, Wearn and Tompkins¹⁹ studied at U. S. General Hospital No. 9 the basal metabolism of 57 cases, in 24 of which the diagnosis of hyperthyroidism had been made by competent observers. In

¹⁸ The Relative Frequency in Recruits with and without Thyroid Enlargement of Certain Signs and Symptoms Which Occur in Neurocirculatory Asthenia, *Arch. Int. Med.*, 1919, xxiii, 316-333.

¹⁹ The Basal Metabolism in Cases of "Irritable Heart of Soldiers," *Medical Clinics of North America*, 1918, ii, 507-515.

none of them was the metabolism above normal, whereas the usual high rate of 60 and 61 was found in 2 true cases of Graves's disease. The problem was studied also by Lewis and his associates, who failed to find a reason for assuming a relation between the two disorders. Although the two conditions have resemblances there is reason for doubting their identity. That malfunction of the thyroid gland may underlie the condition we call the Irritable Heart is a subject still open to investigation. It may produce these signs and symptoms by continuous or by intermittent activity in response to psychic stimuli or to stimuli arising within the body. For the present it is important to lay stress on the fact that the specific knowledge so far accumulated fails to bear out this contention.

It should now be clear that in the Irritable Heart of Soldiers symptoms and signs occur which resemble signs occurring also in convalescence from infections in chronic heart disease and in Graves's disease. But it should be understood that these signs may appear without having a relation to any of these diseases.

On account of the view in which this disorder was held before the war, especially on account of the influence Da Costa had on the subject, these cases were taken to lie in the field of cardiovascular diseases. It has therefore been my purpose to show that in the usual sense there is no abnormality of the heart, nor is the correction of the disorder amenable to methods usually employed in the treatment of heart disease. Indeed, the interest of patients so suffering may be better served at the hands of physicians trained to understand affections of this nature. The point may in fact be raised whether the improper conception has not been productive of harm in individuals who have been treated for heart affections when treatment should have been directed to a neurosis, not only the patient but also the army being sufferers by the mistake.

4. It remains, then, to show on what grounds the view is founded that this symptom complex is neurotic. There are, it is agreed, cases in large number presenting cardiovascular signs and symptoms which it is desirable not to group with those well-defined diseases that have just been discussed. Besides the cardiovascular symptoms of which they complain, it is generally admitted that the patients make that impression of nervousness to which former observers have given attention, even though emphasis has not been laid on this phase of this malady. The nervousness is of the variety already familiarly classed in states of anticipation and anxiety neuroses. The facies is significant of this state; the brow is furrowed; the eyes are troubled; the mouth is drawn. The reaction to unexpected noises is prompt and exaggerated. There is marked shakiness of the hands, limbs, body and head. There is absence of mucous membrane reflexes and exaggeration of the tendon reflexes. There is a tendency to insomnia and to disturbing dreams.

Neurologists and neuropsychiatrists have, during the war period, had plentiful opportunity of studying such cases. Mott²⁰ called them examples of neurasthenia. He says the men "complain of the usual symptoms of neurasthenia—viz., tremors, fatigability by mental and bodily effort; loss of consciousness and irresolution; hyperesthesia, paresthesia and pains which they consider to be rheumatic; fainting attacks; precordial pain and palpitation; feeling of dizziness; insomnia and dreams; loss of appetite; headache and gastric troubles." Salmon,²¹ McCurdy,²² Schwab²³ and others have uniformly interpreted them as cardiac manifestations of the neuroses.

But it is not only the cardiovascular symptoms which have caused difficulty in classification. Gastro-intestinal complaints depending on similar associations have, without doubt, been attributed in the army, as they have been sometimes in civil life, to incorrect causes. Musser,²⁴ for instance, has shown that in the examination of the gastric contents of frank Effort Syndrome cases after the ingestion of a test-meal the acidity continues to rise long after it has returned to normal in control cases. But of great interest are the respiratory complaints which have appeared especially after exposure to deleterious gases. Respiratory distress when associated with the symptoms of Disordered Action of the Heart has been studied especially by Barcroft, Hunt and Dufton²⁵ and by Haldane, Meakins and Priestley,²⁶ and a specific pathology underlying these symptoms has been suggested by them. In their conception the late stages of gas-poisoning present a chain of symptoms comparable to those arising from oxygen want in mountain sickness. Strauss²⁷ saw at Mesves many gassed soldiers who suffered from nocturnal asthma, and he supposed that an abnormality existed over and above a nervous state. There is rapid and shallow breathing, due, according to Haldane, Meakins and Priestley, to exaggeration of the Hering-Breuer reflex. The exaggeration is said to originate in the irritation of the lung tissue after injury inflicted by gassing, "or else by causes acting more generally on the nervous system." Anoxemia follows on this disturbed mechanism and is accompanied by the symptoms of oxygen lack. Polycthemia, first described

²⁰ War Psychonurosis, *Lancet*, 1918, i, 127-129.

²¹ War Neurosis, National Committee for Mental Hygiene.

²² War Neurosis, *Psychiatric Bull.*, July, 1917.

²³ The War Neuroses as Physiologic Conservations, *Arch. Neurol. and Psychiat.*, 1919, i, 579-635.

²⁴ Personal Report to the Senior Consultant in Cardiovascular Diseases.

²⁵ The Treatment of Chronic Cases of Gas-poisoning by Continuous Oxygen Administration in Chambers, Reports of the Chemical Warfare Medical Committee No. 4.

²⁶ Investigations of Chronic Cases of Gas-poisoning, Reports of the Chemical Warfare Medical Committee No. 11.

²⁷ Personal Report to the Senior Consultant in Cardiovascular Diseases.

by Hunt and Price Jones,²⁸ is also present. Barcroft, Hunt and Dufton have shown that treatment of their thirteen patients in a chamber supplied with 40 per cent. of oxygen is followed by relief of the respiratory symptoms and a reduction of polycythemia, temporarily, at least, takes place. This is apparently not true of effort syndrome patients who have not been gassed.²⁹ Unfortunately the late histories of these patients are not available. Unfortunately, also, it has been impossible to study similar cases in the American Army. Medical officers not only in the Expeditionary Forces but also in this country, through the Surgeon-General's Office, were requested to report them on their own account, and because it was supposed they might become important from the viewpoint of war-risk insurance. Cases of cyanosis, bronchitis and asthma have been seen, but their identity with the British cases has not been established. In any case their number is small, but proper leisure and proper facilities for detecting and studying them have not been available.

There is this further group of cases: Many men who were gassed have been examined since the end of the war, and although they no longer complain of respiratory symptoms, and although physical examination and examination by roentgen rays fail to show that a pulmonary abnormality exists, and although their hearts appear to be sound, they complain still of pain in the chest, variously distributed, arising especially on exertion. They complain, moreover, of shortness of breath on exertion, the nature of which, on such careful examination and testing of functional ability as I have been able to make, is quite unclear.

With these facts in view it is striking that in reports by Strauss,³⁰ Levine³¹ and White³² and others the greatest number of cases of the Effort Syndrome occurred among men who were gassed. Strauss especially reported a large number of cases suffering from respiratory symptoms. St. Lawrence³³ studied the effort syndrome cases at the special training battalion, maintained for orthopedic cases at St. Aignan. He found that 9 of 17 cases reporting sick on account of these symptoms were gassed. Of 1500 other cases at the camp, 65 gave a history of gassing, and most of them gave some evidence of the Effort Syndrome of a mild type. The striking thing is that no cases other than those of gas origin showed symptoms sufficient to require report at sick call. "It was interesting to find," says St. Lawrence, "that a neurologist working beside, but independently

²⁸ A Note on the Later Effects of Poisoning by Asphyxiating Gas, Reports of the Chemical Warfare Medical Committee No. 15.

²⁹ Barcroft, J., Hunt, G. H., Dufton, D.: Treatment of Patients Suffering from "Effort Syndrome" by Continuous Inhalation of Oxygen, Reports of the Chemical Warfare Medical Committee No. 12.

³⁰ Loc. cit.

³¹ Personal Report to the Senior Consultant in Cardiovascular Diseases.

³² Ibid.

³³ Ibid.

of me, classified practically the same men as war neuroses." These officers assumed no special pathology for these cases. A reason for the occurrence of the Effort Syndrome symptoms in the gassed is in fact difficult to assign. It has occurred to me that an explanation may be supplied in this fashion. It is known that in the early part of the summer of 1918 gas discipline was not exemplary. Later, for that reason, the immediate and subsequent dangers from gas poisoning were emphasized to such an extent that it is not unfair to say a gas-phobia was developed. Possibly the unequal effect of gas on different individuals added to this attitude toward it. Men, for instance, who were apparently similarly exposed suffered in very unequal degrees. The recollection of these facts during hospitalization may have had an important bearing on the development not only of cardiac but also of respiratory symptoms. The respiratory cases are said to be due to exaggeration of the Hering-Breuer reflex occasioned by an irritative lesion of the lungs, but it is also said that "causes acting more generally on the nervous system" may be at fault. This suggestion, made by Haldane, Meakins and Priestley, is of special interest, for it may be that in their cases the derangement of the Hering-Breuer reflex brings about a disorder of respiration in the same sense that derangement of the vasomotor and cardio-inhibitory centers brings about Irritable Heart of Soldiers, both conditions being expressions of a neurosis. The number of men affected in this manner must in any event be few; 90 per cent. of all the gassed probably return promptly to duty. This was true in the British Army for the Boulogne district.⁴ And of the remainder these considerations apply to a small number only. It is to be hoped that further light on this subject may be shed by studies pursued by the method of exact investigation.

That there are still other ways in which men suffer, aside from symptoms referable to the cardiovascular, gastro-intestinal and respiratory systems, is well known. The musculoskeletal system was frequently the method of expression of the neurotic state. This form is familiar in aphonia and in contractures and has been abundantly described in the neurological literature. I desire merely to point out that these are probably other manifestations—other expressions of a similar psychic mechanism.

It seems scarcely necessary to dwell on the reasons for the occurrence of anxiety states in the war. Descriptions of its terror were sufficiently familiar, so that an anticipation of what he might experience was lively in the mind of the least instructed recruit. This anticipation was operative in British recruits in England, we are told, as well as in the United States. It is, of course, clear that men vary in their behavior in the anticipation of such expe-

⁴ Elliott quoted by Meakins, J. C., and Priestley, J. G.: Reports of the Chemical Warfare Medical Committee No. 16.

riences. We recognize the timorous and the bardy. That the timorous had a lively antagonism to leaving the United States on such an expedition need surprise no one. Such men were plentifully seen. Whether their dislike for adventure of this kind be attributable to constitutional inferiority, to race or to other causes is a matter of interest. It has been shown by Wolfsohn³⁵ and by Oppenheimer and Rothschild³⁶ and by Campbell³⁷ that heredity and previous personal history are significant factors in those men who are the first to fall out showing the symptoms of the Effort Syndrome. The mechanism of inferiority of this type is an important study. A difficulty with all these investigations is that they fail to consider the behavior of those men of similar family and personal history who managed to endure successfully the hardship and anxiety of war. Nor does it suffice in a study of this nature to assign a reason for failure in the case of the men who failed first and to dismiss the subject with the discovery of these so-called inferiors. The literature of the neuropsychiatrists contains the histories of many men who entered the war in the class of the hardy, and who, in the end, failed as the timorous failed in the beginning. It requires little imagination to understand the influence the sights and sounds and the experiences of actual warfare must have had gradually to wear down the endurance of the most resistant; for this reason many of the hardy failed. No doubt many men passed through the war psychically untroubled. But no doubt, also, it would have been difficult at the beginning to predict which men were likely to endure. Men the least likely may have succeeded; men the most likely may have failed. Men may indeed all be regarded as being vulnerable in this regard. The timorous naturally succumb first. They are often those who had already suffered from the wear and tear of life when the war began. The war itself supplied wear and tear, and as the hardier suffered, they, too, were worn down; they too, succumbed. There is involved, then, from this point of view not one factor, native predisposition, but two, native predisposition and time. That after four years of war, men as unlikely for service as any that were seen in our cantonments were numerous in the British Army, anyone who saw the cases at Colchester can testify. It may be said that the time factor applies only to the hardy, and this may be true. But no report has taken into account the successes of the less bardy and of the timorous—and, unquestionably, there have been many such. Taking constitutional predisposition into account is essential, but as a complete account of failure it appears to be inadequate.

³⁵ The Predisposing Factors of War Psychoneuroses, *Lancet*, 1918, i, 177-180.

³⁶ The Psychoneurotic Factor in Irritable Heart of Soldiers, *Jour. Am. Med. Assn.*, 1918, lxx, 1919-1922.

³⁷ The Role of Instinct, Emotion and Personality in Disorders of the Heart, *Jour. Am. Med. Assn.*, 1918, lxxi, 1621-1626.

This view suggests the reason for a difference in the nature of the cases seen here and seen in France. The difference was apparent to numerous observers. Here the undoubtedly timorous floated to the surface directly, were recognized immediately and were eliminated. This type became well defined. They were the constitutionally predisposed, the timorous. There reached France those of this group with more of reserve and these no doubt fell first there. But, on the whole, the hearing of those who came to France was better and the general impression they made superior. This difference accounts for the distinction that has been made between the classes seen in the two places.

Other facts bear on the probability that the symptoms of Irritable Heart depend on a neurosis. The symptoms were all but unknown in the severely wounded. The faces of these men were turned definitely away from the front. The same may be said of the severely gassed. And it is commonly admitted that prisoners of war were quite free from such ailments. All these men were finished with the war. It was most striking that in the week following November 11, 1918, the day of the signing of the Armistice, it became difficult, while travelling, as I undertook to do, among the Base Hospitals, to find the cases which had been so frequent. Their number diminished, practically disappeared, except for the more severe types. The same observation was made in respect to the musculoskeletal cases, the so-called functional joint cases. At Base 117, the neuropsychiatric hospital, special precautions were taken lest the disappearance of symptoms receive tactless comment, with subsequent injury to the patients. It is not the intention, however, to contend that no cases were seen after this time. Reasons for the presence of Irritable Heart cases, perhaps as numerous as in civil life, remained, and there were added other reasons for their occurrence as well. A similar situation prevailed among the neuropsychiatric cases.

The outlook for the cases of Irritable Heart depends on the conception one has of their nature. If, in essence, they depend on malfunction of the thyroid gland or on malfunction or hypertrophy of the heart in Da Costa's sense, their future will be foretold as that of these conditions. But if the symptom complex is regarded as a neurosis, there is, with suitable treatment, reason to think that recovery will take place in all but the severe cases. Hume,³⁸ for instance, returned the cases after four weeks. In an army it is, however, not enough to return men to the front; unless they are genuinely fit for duty, they retard rather than help the work of their organizations. There are available statistics such as Lewis's and Bridgman's to show what the result of treatment has been. It is, however, important to have records on a greater scale.

³⁸ *Loc. cit.*

Viewed as a neurosis, then, the outlook for a rapid recovery is favorable. But if the view of Da Costa is taken, of the possibility of a functional derangement of the heart passing into an organic, a hypertrophic one, the difficulty of prognosis is greater. For here, so far as service is concerned, the soldier ought probably to be discharged and his future viewed with uncertainty. Herein is involved the question of the size of the soldiers' hearts, of which mention has already been made.

Treatment similarly awaits a decision on the nature of the disorder. Here, too, Da Costa had definite views. He put patients to bed to rest and he gave them drugs—digitalis, aconite, atropin—which he believed did good, each for a different phase of the malfunction of the heart. The effect of a number of drugs has been tried by Parkinson³⁹ and others during this war at Colehester. It may be said, in brief, that these were without benefit. Graduated exercises were introduced by Lewis, both to sort men with a view to determining their class of service and also to ameliorating their symptoms. There can be no doubt that, so far as classifying is concerned, the introduction of the graduated exercises was a work of signal usefulness, and giving them prominence had important results. It would, however, be ungracious to fail to recall that Da Costa made use of a similar method. It is another matter, however, whether the exercises are of benefit at the root of the malady. If Irritable Heart is a neurosis based on anxiety it is clear that exercises conducted by a drill sergeant do not meet the therapeutic indication. It is doubtful whether strength can be supplied in this manner, especially when one considers that in anxiety and fear strength ebbs—strength being then a neurological not a muscular function. It may be that the James-Lange law is applicable in this connection—that one is anxious because one's strength has fled. Into this discussion we cannot enter. But so much it has been necessary to mention to indicate the inadequacy of graded exercises as a therapeutic measure.

In the Expeditionary Forces we were led, after reflection, to adopt the view that the Irritable Heart of Soldiers was the expression of a neurosis. It was for that reason that the chief surgeon was prevailed upon to abandon the designation "Disordered Action of the Heart" (D. A. H.), borrowed from the British. For that reason, also, no term was recommended in substitute in which any organ or system of organs in the body was mentioned. It was thought a term so constructed would have unfortunate consequences, both for the individual and for the army. The term Effort Syndrome was borrowed from Lewis for several reasons: We could devise no better one; it avoided the difficulty of others already or formerly

³⁹ Parkinson, J.: Digitalis in Soldiers with Cardiac Symptoms and a Frequent Pulse, *Heart*, 1915-17, vi, 321-336.

in use; its choice was a recognition of the great service Lewis had done in bringing prominence to the subject. That we came in the end to ascribe to the term a different meaning from the one he gave to it was of small consequence; for while he thought of the affection as a syndrome resulting from effort—from any effort, in fact—we thought of it as one developing, under special circumstances, from a peculiar effort, the unusual effort demanded by the war and the unfamiliar stimuli associated with it.

The disorder having been studied and the name of the disorder having been selected, we addressed ourselves to making recommendations for the care of the patients. In this we availed ourselves of the experience of the British, who, in many respects, had attained, it seemed to us, conspicuous success. The most important advice the British gave us related to the location of convalescent camps for their reception. The British thought, and experience showed, that the camps should be built as far as possible away from the hospitals—five, ten or fifteen miles. Our convalescent camps, however, formed an integral part of the great hospital centers. The immediate effect of this was to impair the morale of the convalescent camp and to prevent the introduction of suitable therapeutic measures, because on account of the necessarily rapid rate of growth, convalescent soldiers were utilized as labor and construction troops. It is possible and even probable that the men did not suffer under this system, but it prevented an attempt at systematic therapeutic supervision by medical officers. And it was not only impossible for medical officers properly to fulfil their functions, but being untaught in work of this nature it prevented their acquiring necessary experience.

The location and administration of the camps were then, during the war period, unsatisfactory. Whether time, had the war gone on, would have improved this situation it is impossible to say. It is a pleasure to record, however, that those of our medical officers who were especially trained by Lewis and others for this work were unusually faithful, remained cheerful under strikingly trying circumstances and could not have failed in the end to accomplish noteworthy results.

For the soldiers the camp, as the British designed it, had a specific work to do. It was to give him back his morale, his cheerfulness and his courage. He should emerge from the camp ready to undertake his share of the burden willingly. It cannot be said that we made any important contributions to the technique of managing the soldiers. We were learning when the war ended and were meanwhile availing ourselves of the experience of the British. They taught us first that there was necessary in the camp an attractive atmosphere. The barracks or huts must be well arranged and laid in grounds well cared for and landscaped. Surprising results in gardening are possible in France in a year. The soldiers,

divided in companies and battalions, were kept on a modified but strict discipline. They were instructed and amused, or, preferably, they were taught to amuse themselves. There were setting-up exercises, marches with the band; there were round games and tennis, golf and cricket; athletic competitions, lectures and picture shows. Auxiliary agencies were welcomed; the Red Cross, the Y. M. C. A. and as many more as had entertainment to offer. There were theatricals, often arranged by the men themselves; these last longer and stimulate more interest than those supplied to them. And there was plenty of music; in one British camp there were two brass bands, an orchestra, a mandolin and a banjo club. And there are many other ways of keeping the men entertained and of resupplying enthusiasm for an experience undertaken none too eagerly. Presiding over the whole were the medical officers, especially selected for this difficult and important salvage work, under whose immediate direction the work went on, the detailing for exercises and games, the graduation for fitness from class to class. With this system results were obtained. Many a soldier returned to his work uplifted in mind and in spirit, cheerfully willing to make his sacrifice afresh. It is a mistake, however, to suppose that the British acquired their camps full-blown; one commanding officer told me that the acquisition of every single piece of wood in the place represented an argument. But it was to a system like theirs to which we looked forward, and which, no doubt, we should have approached this summer had not the war fortunately cut short our career.

For civil practice this experience has a lesson. There are many unfortunates who fall into this group of patients. It will not be seriously contended that the practice of medicine has adequately studied or solved the problems connected with this phase of disease. There are problems in pathogenesis, problems in the mechanism of the disorder, problems in therapeutic organization awaiting solution.

In this paper it has been the special purpose to point out milestones in the history of this subject. Da Costa first defined it; on the basis of his work the study continued in this war. In his view the disorder arose most often as the result of infectious diseases, was most likely a functional disorder, going on to organic change in the heart, and was certainly affected beneficially by drugs. The symptoms which he described, and which we recognize, are alike. We differ from him in that we think that no matter what the predisposing cause, whether it be infectious disease, malfunctioning glands of internal secretion or gas-poisoning, the disorder is essentially a neurosis, depending on anxiety and fear; that it is removed by the disappearance of the exciting cause and that it is cured by measures designed to influence the neurotic state.